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AUTHOR	Neumann, Gaby; Krzyzaniak, Stanislaw; Lassen, Carl Christian
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ABSTRACT

This paper describes a research and development project initiated by a network of European logistics educators to promote all types, forms, and levels of logistics education by benefiting from the educational potential of multimedia/hypermedia as well as information technology and telecommunications. The main outcome of this project will be a learning process personalizing, integrating, infrastructure that is manifested as the Logistics Knowledge Portal. The Logistics Knowledge Portal is available on the Internet as a resource for developing a personalized learning path for employees, students, and other interested bodies, and is based on the in-depth understanding of learning needs and goals and managed under a classification method for learners and categorization method for all available technology-based learning material. The project aims at providing a solution to problems in logistics learning in Europe and worldwide. Many of its results are expected to be of fundamental nature and therefore applicable to other domains of knowledge. (Author/AEF)

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The Logistics Knowledge Portal: Gateway to More Individualized Learning in Logistics

Gaby Neumann
Department of Logistics and Materials Handling Engineering
University of Magdeburg
Germany
e-mail: gaby.neumann@mb.uni-magdeburg.de

Stanislaw Krzyzaniak
Institute of Logistics and Warehousing
Poland
e-mail: stanislaw_krzyzaniak@ilim.poznan.pl

Carl Christian Lassen
Institute for Applied Engineering and Production
Technical University of Denmark
e-mail: ccl@akp.dtu.dk

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Abstract: The paper describes a research and development project initiated by a network of European logistics educators to promote all types, forms and levels of logistics education by benefiting from the educational potential of multimedia/hypermedia as well as information technology and telecommunications. Main outcome of this project will be a learning process personalizing, integrating infrastructure that is manifested as the Logistics Knowledge Portal available on the Internet as a resource for developing a personalized learning path for employees, students, interested bodies, based on the in-depth understanding of learning needs and goals, managed under a classification method for learners and categorization method for all available technology-based learning material. With this the project aims at providing a solution to problems in logistics learning in Europe and world-wide. Furthermore, many of its results in both, research and development, are expected to be of fundamental nature and therefore applicable to other domains of knowledge too.

1 Current Situation in Logistics Learning

Logistics learning has been chosen as an exemplary area of elaborating concepts and tools for developing personalized learning paths because of some specific features of this research and practical discipline. ***Logistics*** – in its widest scope of understanding – is an extremely rapidly developing field of knowledge and practical applications. The development goes in different directions: the one of new concepts, strategies, organizational solutions on one hand, and the one of new technical applications (most of them IT based) on the other. Besides logisticians operate in a dynamically changing environment of globalized economies linked by international and intercontinental supply chains, new opportunities brought by e-commerce. These ongoing challenges demand for an ongoing updating of professional knowledge and skills by all who work in the field of logistics, who work in other fields but have to take logistics effects into consideration, who want to or need to understand the logistics context from the technological, economic, environmental, administrative or social point of view. Even initial logistics education processes at vocational and higher education levels must be a part of these dynamic changes to enable their graduates to meet employers' needs and perform at the market. So, logistics learning is required to be flexible with respect to

- ***learners*** (in the widest sense) and their individual targets, motivations to learn, specific requirements and constraints,
- varying ***educational needs*** resulting from the learner's targets, motivations, requirements and constraints, like e. g. scope and level of knowledge, particular skills etc., and

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- appropriate ***educational resources*** developed and used in form of modules and courses fulfilling the educational needs and helping the learner to reach the required, established goal.

Before this background the current situation in logistics learning can be characterized as follows:

(i) The educational resources in logistics are numerous, but scattered and not inventoried, so there is no structured access to what is available, just a little knowledge of gaps and no formal mechanism at all for identifying these gaps and filling them with good quality units.

(ii) There is a great need for various forms of education in logistics and a potentially large pool of supporting resources, but there is no interface between those two market sides (demand and supply).

(iii) Generally, learning processes are not supported by methods and tools enabling to configure personalized learning paths. Educational technology is selected intuitively with many important conditions not being considered. This often results in inefficient learning processes achieving results not in any case meeting the learner's and/or teacher's expectations.

Especially the latter is true not only for logistics learning, but for technology-based education in a wide range. So, it can be stated that there is a general need to help learners understand their targets and constraints, to translate them into educational requirements and to configure personalized learning paths composed of available resources. This is the clue to achieve the required and intended improvement of knowledge, abilities and skills, to reach the individual targets of the learning process in shorter time and better quality.

2 Portals – Technology to Provide Access to Information, Knowledge and Services

Diaz (2000) defines portals as web sites configured for each user in order to filter information. ***In the world of logistics*** there is a growing number of examples for such portals: LogisticsWorld (2000) understands itself as a directory of logistics resources on the internet guiding to thousands of web sites related to all aspects of logistics knowledge and business. Amongst many others there is also a category on education providing a list of 216 links to a great variety of educational institutions at all levels and a number of marketplaces providing educational products and learning material world-wide. transportal (2000) is a portal made and maintained by the Danish Board for Education and Training covering 130.000 people employed in transportation and logistics. It provides links to a wide range of information relevant to the portal's users. Its major feature consists in giving an overview of all educational institutions having logistics related activities, from universities to vocational training schools, and supporting apprentices to get jobs and companies to look for people.

From the educational point of view many efforts are put into the creation of libraries of educational resources such as the EOE Java Applet Library (EOE, 2000) to reduce developmental efforts by sharing small units being building blocks of larger modules or enabling the re-use of materials and solutions developed for a particular purpose. For this, standards for describing resources stored in there as well as tools to develop learning content compatible to these standards are provided (see ARIADNE, 1999 or IMS, 2000). Other developments such as Braincapital (2000), transportal (2000) or Workingday (2000) aim at creating networks and platforms to bring together learners and those offering education and training or employers and those looking for a job. Such career networks are contact points providing access to a particular set of educational needs and resources.

Although a large amount of material exists in the internet, it is not an easy task to find what you look for. Seeing this problem, existing portals act as knowledge brokers linking knowledge users and knowledge providers with respect to a specific field of knowledge. They are more or less sophisticated search engines where users have to chose a particular topic from the list or specify a set of keywords in a dialogue or menu. Usually the portal's response consists of a list of links with only a few information about what might behind them. In the end, the user would have to follow systematically all links to find the most suitable one for his or her purpose. Since this is very time-consuming again, the majority of users is selecting one of the links by randomness or according to the attractiveness of its description to see whether or not this fulfils expectations.

To help finding, structuring and delivering the best information matched with the particular needs of the learner(s) and with this to really serve educational purposes, a knowledge portal must offer additional functionality to determine the learner's prior knowledge state, to determine the nature, the quantity and the level of lessons to be imported in order to achieve a specific learning goal, and to provide a pedagogical framework for supporting the learner achieving his or her educational objectives. To fulfil these requirements and truly assist the user in creating

educational or even better learning processes, a portal should be designed in a way brokering knowledge in form of educational resources from the knowledge user's, i. e. the learner's perspective rather than serving knowledge providers in selling their products. It should not only manage content, but also enable to match content more closely to the needs of users' sectors and communities. Pre-condition for this is to understand the learners' individual learning experience and behavior (expressed in different ways of learning and also different pace of evolution).

3 The Project

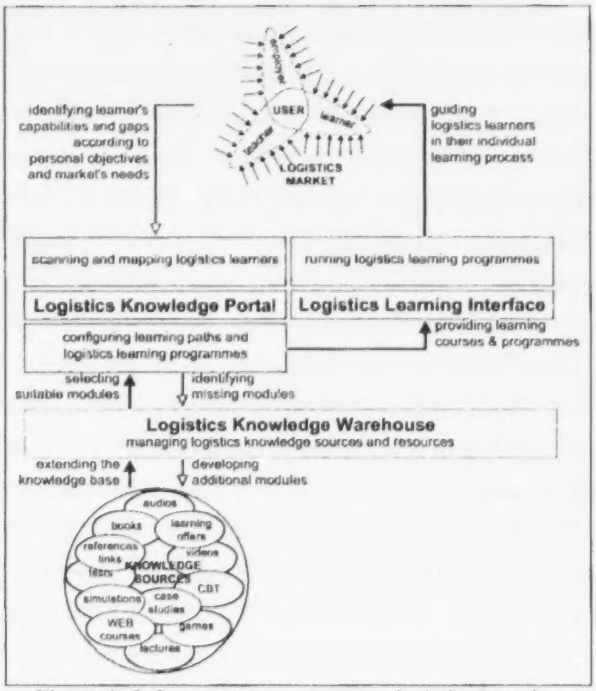

Figure 1: Infrastructure to promote logistics learning

For promoting individualized logistics learning processes according to the specific needs of the individual learner and the particular domain of logistics a European project was initiated. Project partners are experts from areas covered by the project: Pedagogy, computing and logistics as the domain. In particular the consortium brings together experts in logistics and logistics education from universities and commercial training organizations from Denmark, Germany, Greece, Poland and Sweden and experts in computing, AI and IT from Denmark, Greece and the UK. Potential users are involved in all project phases via the European Logistics Association (ELA) representing 36 national logistics organizations from all over Europe and with this providing access to hundreds of thousands of logisticians. In addition to this the project is supported by local administration and further universities; it is linked to other educational logistics networks active in particular regions of Europe such as Scandinavia, Denmark, Germany, to a transatlantic network of European and US universities and companies providing intensive logistics education in a global frame and last but not least to the ELA-LogNet which is a European network of logistics educators representing all types and levels of logistics education to promote technology-based logistics learning.

The project aims at designing, developing, setting up, testing and demonstrating a sophisticated IT-based infrastructure enabling to match educational requirements with resources in a logistics learning information network. This infrastructure will provide potential users of varying types with appropriate, innovative methods and tools within a user-friendly, adaptable environment which guides users according to their demands and individual goals through the system's broad functionality. The special value and innovation of this solution consists in its user-centered approach for providing an integrated platform consisting of more or less known and already developed

functional modules, supported by unique purposefully developed modules generating personalized, dedicated, tailor-configured learning paths. As a result three major components (see figure 1) will be available, each of them covering a set of methods and tools of immense, innovative, intelligent functionality and great complexity:

- the ***Logistics Knowledge Warehouse*** which is an on-line, computer-based storehouse of expertise, knowledge, experience, and documentation about logistics,
- the ***Logistics Knowledge Portal*** which is an IT-based infrastructure for providing access to and brokering of logistics knowledge to enable personalized logistics learning processes, and
- the ***Logistics Learning Interface*** which is an IT-based infrastructure for running and managing logistics learning programs and their users (learners and teachers).

At service level, work addresses Web based services including Web communities, agent-based services, user profiling, and content mediated transactions, together with contextual, intelligent or adaptive access to, and delivery of heterogeneous assets in large distributed and multi-owner collections. It covers technical areas like consumer protection and privacy, IPR, open standards for interoperability and access management guidelines and business models. With this the project aims at building a global knowledge, media and computing space providing the right/relevant knowledge of high/approved quality on time, in good order to the user and enabling interaction which is at the same time supportive and empowering.

4 The idea and concept of the Logistics Knowledge Portal

The heart of this innovative solution is formed by the ***Logistics Knowledge Portal*** which can be described as a set of intelligent engines (see figure 2) mediating between the various types of users and the enormous amount of logistics knowledge sources already available or coming up in future. It combines sophisticated functionality to understand learners and their very special learning needs by scanning and mapping them with truly innovative functionality to develop – this is to be understood in the sense of proposing and suggesting – individual, learner-specific, personalized logistics learning paths and courses by using AI-based configuration methods and tools to select suitable learning modules from the Logistics Knowledge Warehouse and link them according to the learner's particular needs.

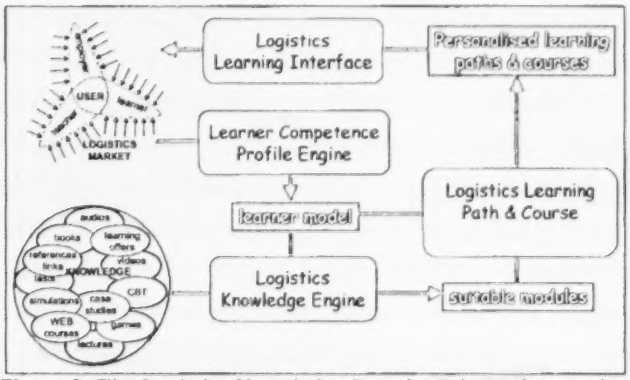

Figure 2: The Logistics Knowledge Portal – Schematic overview

The ***Logistics Learner Competence Profile Engine*** characterizes a learner or a group of learners according to current knowledge, skills, abilities, learning styles and other personal information to be included in a learner model which is used as an identity card to allow access to specialized modules/courses, or as part of an intelligent tutoring system. Information required for this can be provided either directly by the user, i. e. the learner, teacher or employer defining learners, their targets as well as educational needs or indirectly e. g. by analyzing a company's need for providing logistics education to employees. The latter methodology is implemented in a tool identifying/measuring the company's logistics maturity (represented by a radar diagram), recommending the target logistics knowledge for different categories of employees, and proposing possible educational activities. The results of this initial scanning and mapping process are stored to be the basis for evaluating the outcomes of the initiated learning process.

The ***Logistics Knowledge Engine*** links the Logistics Knowledge Portal to the Logistics Knowledge Warehouse by translating learning goals described in the learner model into a number of inter-related topics in the form of a specific domain model to be addressed including a rich set of examples, hints, simulation and usual misconceptions. For this, a contextual search engine selects those learning modules from a knowledge base which fit most to the learner's needs and user's specification and forward them to the configuration procedure. Carrying out the search for particular units and modules the system also identifies gaps in the sense of missing modules and transforms the search contents into a corresponding description of requirements to be fulfilled by a module closing this gap. With this, the stock of available learning resources evolves and grows over time in response to user demands.

The ***Logistics Learning Path and Course Configuration Engine*** contains a set of tools for the personalized configuration of learning paths for all possible established educational requirements meeting the learner's needs and targets. In a first step, conceptual learning paths for present and future learning activities are planned by selecting learning patterns with respect to the learner model and adapting them to meet the specific educational needs of the course to be configured. This empty frame of a learning path is now filled with suitable units and modules as provided by the knowledge engine. Often there is more than one module meeting particular needs or more than one possibility to inter-link them or there is a variety of learner models to be served by the course. In this case alternative learning paths are configured. Completed by appropriate tutoring models, they form the new (or modified) course which is described and classified to be added to the stock of available courses. At another situation they could be selected directly with respect to the learner model to avoid additional course creation efforts. The final version of a course is integrated into the learning interface to be used by learners and evaluated at the same time.

Although the Logistics Learning Interface can be described as the output device enabling to run learning paths and courses, it is closely linked to the Logistics Knowledge Portal. This is caused in the ***Logistics Learning Evaluation Tool*** embedded in the learning interface, which helps to understand what and how the learners really learn and encourages them to reflect on their learning. Its concept is based on an existing tool for evaluating learning activities by carrying out reaction and satisfaction measurements (e. g. on course conditions and content, or on the improvement of knowledge and skills) with the help of automatically generated questionnaires and methods for advanced statistical analysis (CUE, 2000). Information provided by it are used to evaluate both the learning path/course as configured and the learning process as run by the learner by matching them against learning needs and expectations as identified by the Logistics Learner Competence Profile Engine to determine the usefulness of content, methods and modules as well as areas to be improved and future consequences of changes in the course.

The Logistics Knowledge Portal is expected to be a practical solution to the current educational problem in the field of logistics. It shall integrate developers of educational modules and provide them with the prompt information on desired directions of new developments. It shall help learners all over Europe (whoever they are: individuals or organizations) to gain the new knowledge and skills in the most efficient way in terms of required general target, quality, time and cost. With this the concept of a knowledge portal designed to assist learning is not limited to the logistics knowledge domain only. The presented solution is based on many generally applicable principles, methods and tools e. g.

- to identify learner's capabilities and gaps according to personal objectives and market needs and to transform this input into adequate learner models,
- to describe and select learning resources and configure learning paths basing on suitable learning patterns, but adaptable to the learner's individual needs,
- to encourage feedback from the learner and analyze the learning process to understand in which scale the configured learning path and course met the learner's needs and expectations, or
- to guide the user through the configuration process and assist him or her according to the particular needs by intelligent agents

which easily can be adapted to other domains by implementing domain-specific knowledge on learners, educational needs, educational resources and last but not least the way of learning.

4 State-of-work and future challenges

As the first step for developing the Logistics Knowledge Portal a ***prototype demonstrator*** is going to be implemented to visualize the idea in principle, major functionality of the engines and the user-interface concept. It

wil
transnational user groups to gain feedback on the basic approach and identify additional user needs. According to

being presented at the conference.

Future challenges consist in

- rope-

  classification framework,

  conditions, current and target skills -
  identified learner classes and the developed learner categorization framework,
  providing tools to establish educational requirements related to given or id
  respect to all specified constraints,
  providing agent based tools for the personalized configuration of learning paths for all possible established

- ods and tools for encouraging and analyzing learners' feedback on experience, impressions, criticisms provided while and after the learning process,
  providing mechanisms for identifying emerging gaps in the available pool of educational resources (Logistic Knowledge Warehouse) and
  providing all necessary tools for the system administration.

For this only those functionality (methods and tools) will be implemented which is necessary to reach these goals and enable the Logistics Knowledge Portal's extended, valuable testing, validation and demonstration. To reduce the developmental efforts already existing approved solutions and products will be adapted and integrated as much as possible. Further research will mainly focus on understanding logistics learning needs and modeling logistics learners, identifying learning patterns typical for learning logistics, setting up a rule base for configuring learning paths according to the learning needs, enabling the system and the user to learn from the learning process, applying AI technology and providing intelligent agents to guide the user and give individual support.

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